

I CLAIM:

1. A system for optimizing the performance of an operating crew of at least one aerial vehicle during at least one close-in air combat by providing in real-time automatic situation assessment and by generating dynamically at least one indication and by communicating the at least one indication as guidance to the operating crew of the at least one aerial vehicle, the system comprising the elements of an assessment information database implemented on at least one computer; and an assessment and guidance software application implemented on the at least one computer.
2. The system as claimed in claim 1 wherein the assessment information database comprises the elements of:
an aircraft characteristics file comprising the aircraft flight envelope, the aircraft maneuver-energy graphs, models and limitations, and the aircraft weapon system characteristics;
a set of formulas for optimal relative maneuvering file; and
an external information file.
3. The system as claimed in claim 1 further comprises the elements of at last one computer installed on the at least one aerial vehicle or on at least one ground station to receive, store, process and forward data specific for the optimization of the conduct of the at least one aerial engagement.
4. The system as claimed in claim 1 further comprising at least one off-board computer installed in at least one ground station to provide additional data specific for the optimization of the conduct of the at least one close-in combat engagement.
5. The system as claimed in claim 1 further comprising at least one sensor device installed on the at least one aerial vehicle to dynamically monitor the physical

variables associated with the participant elements of the at least one close-in air combat.

6. The system as claimed in claim 1 further comprising at last one sensor device
5 installed in the at least one ground station to monitor physical variables associated with the participant elements of the at least one close-in air combat.

7. The system as claimed in any of claims 1-5 further comprising at least one data
communication network linking the at least one aerial vehicle and the at least one
10 ground station to allow for the transmission or reception of the information associated with the at least one close-in air combat.

8. The system as claimed in claim 1 wherein the assessment and guidance application comprises the elements of:

15 an application control module to initiate, to activate, to control and to execute the application;
a database interface module to allow for access the database and to obtain the requested records from the database;
a parameters processor module to handle the operational parameters of the system;
20 an information-marshalling module to organize the information received from various sources;
a situation analyzer and mapping module to analyze the at least one current situation concerning the at least one aerial engagement; and
a response assessment and response selector module to generate at least one
25 response associated with the at least one current situation and the at least one potential situation.

9. The system as claimed in claim 8 wherein the assessment and guidance application further comprises any one of the elements of:

- a future situations projector and mapping module to create at least one potential future situation and associating the at least one future situation with the at least one current situation;
- a post-combat debriefing module;
- 5 a guidance generator module to convert the at least one selected response to at least one guidance instruction;
- a guidance display module to communicate the at least one guidance instruction to the operating crew;
- an aircraft status and system status monitor;
- 10 a learning and adaptation module;
- a history generator and history replay module;
- an air combat formulas or algorithms or a set of rules module or algorithm;
- a testing/maintenance/initialization module; and
- a user interface module.
- 15
10. The system as claimed in claim 1 wherein the computer further comprises the elements of:
- a communication device to link the at least one computer to remote information sources via the at least one data communication network;
- 20 a processor device to execute the required sequence of software instructions embedded in the assessment and guidance application;
- a digital signal processor device to process digitally formatted information from the at least one sensor device and from the at least one data communication network; and
- 25 a data bus device to provide at least one data delivery channel among the diverse devices installed in the at least one on-board device.
11. The system of claim 10 further comprising a sound synthesizing device to generate audio instructions to be communicated to the operating crew of the least
- 30 one aerial vehicle.

12. The system as claimed in claim 8 wherein the assessment and guidance application further comprises any one of the elements of:
an operating system to supervise and control the execution of the programs installed in the at least one computer;
- 5 a data link handler component to initiate transmission of outgoing information and to receive incoming information from the at least one data communication network;
an input/output handler component to supervise and control the peripheral devices linked to the at least one computer;
- 10 a database handler component to initiate access to the assessment information.
13. The system as claimed in claim 11 wherein the sensor device is an instrument providing an indication as to the parameters of flight.
- 15 14. The system as claimed in claim 11 wherein the sensor device is a global positioning system device.
15. The system as claimed in claim 1 wherein the at least one aerial vehicle is a manned combat aircraft.
- 20 16. The system as claimed in claim 1 wherein the at least one aerial vehicle is an unmanned combat aerial vehicle.
17. The system as claimed in claim 1 wherein the operating crew is a fighter pilot.
- 25 18. The system as claimed in claim 1 wherein the operating crew is a remotely located operator.
19. The system of claim 3 wherein the computer is an onboard computer located
30 within the aerial vehicle.

20. The system as claimed in claim 1 further comprises the element of a visual display device to communicate the at least one instruction to the operating crew in a visual manner.

5

21. The system as claimed in claim 1 further comprises the element of an audio output device to communicate the at least one instruction to the operating crew in an aerial manner.

10 22. The system as claimed in claim 1 further comprises the element of a manual input device to communicate control information from the operating crew to the system.

15 23. The system as claimed in claim 1 where the at least one close-in air combat is a within visual range air combat.

24. In a virtual aerial combat environment a system for optimizing the performance of an operator of at least one virtual aerial vehicle during at least one virtual aerial engagement by providing automatic situation assessment and by generating
20 dynamically at least one maneuver or energy instruction and by communicating the at least one maneuver or energy instruction as maneuver or energy guidance to the operator of the at least one virtual aerial vehicle, the system comprising the elements of:

an assessment information database installed within at least one air-combat
25 simulating software environment associated with the at least one virtual aerial vehicle; and

an assessment and guidance software application installed within at least one air combat simulation software environment associated with at least one virtual aerial vehicle.

30

25. The system as claimed in claim 24 wherein the virtual air combat environment is a flight simulator.
26. The system as claimed in claim 24 wherein the virtual air combat environment
5 is a computer game.
27. A method for optimizing the performance of an operating crew of at least one aerial vehicle during at least one close-in air combat by providing in real-time automatic situation assessment data and by generating dynamically at least one
10 instruction and by communicating the at least one instruction as guidance to the operating crew of the at least one aerial vehicle, the method comprising the steps of:
- for each one of at least two aerial vehicles:
- obtaining air combat engagement and energy information required for the analysis
15 of the air combat situation;
- obtaining aircraft characteristics information required for the analysis of the air combat situation;
- obtaining aircraft weapon system characteristics information; and
- obtaining remotely sensor-specific information;
- 20 analyzing the situation between the at least two aerial vehicles and mapping the analyzed situation in relation to the previously analyzed situations between the at least two aerial vehicles;
- generating at least one future potential air combat situation based on the at least one mapped air combat situation;
- 25 determining at least one optimal state of the at least one aerial vehicle based on the at least one optimal air combat situation between the at least two aerial vehicles;
- generating at least one recommendation based on the at least one optimal future potential air combat situation between the at least two aerial vehicles.
- 30 28. The method as claimed in claim 27 further comprises the steps of:

transforming the at least one recommendation into at least one guidance indicator;
displaying the at least one guidance indicator to the operating crew of the at last
one aerial vehicle to enable the application of the associated commands to the
controls of the aerial vehicle.

5

29. The method as claimed in claim 27 further comprises transforming the at least
one recommendation into at least one direct input commands to be automatically
applied to the suitable controls of the at last one aerial vehicle.

10 30. An apparatus for optimizing the performance of an operating crew of at least
one aerial vehicle during at least one close-in air combat by providing in real-time
automatic situation assessment, the apparatus comprising:

a device for:

obtaining air combat engagement and energy information required for the analysis

15 of the air combat situation;

obtaining aircraft characteristics information required for the analysis of the air
combat situation;

obtaining aircraft weapon system characteristics information; and

obtaining remotely sensor-specific information;

20 an analysis device for:

analyzing the situation between the at least two aerial vehicles and mapping the
analyzed situation in relation to the previously analyzed situations between at least
two aerial vehicles;

25 generating at least one future potential air combat situation based on the at least
one mapped air combat situation;

based on the analysis determine at least one optimal state of the at least one aerial
vehicle based on the at least one optimal air combat situation between the at least
two aerial vehicles; and

30 generating at least one recommendation based on the at least one optimal future
potential air combat situation between the at least two aerial vehicles.

31. The apparatus as claimed in claim 30 further comprises:

a transforming device for transforming the at least one recommendation into at least one guidance indicator;

- 5 a display device for displaying the at least one guidance indicator to the operating crew of the at last one aerial vehicle to enable the application of the associated commands to the controls of the aerial vehicle.

32. The apparatus as claimed in claim 30 further comprises a transforming device

- 10 for transforming the at least one recommendation into at least one direct input commands to be automatically applied to the suitable controls of the at last one aerial vehicle.

15